INTRODUCTION

Speed in traffic is a critical issue, since it is:
- an important efficiency factor for drivers
- a key geometric design parameter (operating speed)
- the most influential risk factor (the most frequent cause of road deaths on Czech roads)

How to study speed and safety:
- speed models (relating speed to design consistency factors only, mostly curve radius, although speed chance is influenced also by cross-section, road marking, vegetation, etc.)
- safety models (safety performance functions: crashes as a function of exposure and risk)
- both approaches usually carried out separately

A combination of speed and safety models:
- some SIF's involved consistency variables (computed through speed models, as a difference between tangent and curve speeds)
- development of these SIF's thus involves both models
- from SIMPLE speed models (often using radius only) to COMPLEX safety models
- some authors applied the same variables in both models at the same time

An innovation (inspired by T.A.):
- an opposite variant of a two-stage model
- from COMPLEX speed model to SIMPLE safety model
- consistent with the principle of parsimony

The objective: to prove feasibility of development and application of a 'two-stage' speed and safety model in the study of environment, speed and safety factors.

DATA AND METHODS

A sample of Czech two-lane rural roads (excl. intersections), approx. 100 km (60 mi)
- driven through two weekends, in one direction, as close as possible to free-flow speed
- 10 Hz GPS = 2.5 m @ 80 km/h (0.25 ft @ 50 mph)
- 316 segments in total (158 tangents and 158 curves)
- Speed (V) and curvature change rate (CCR) calculated for each segment

Environment data (from Google Maps or road database):
- Roadside vegetation: none or bushes / single trees / trees in a row or forest
- Road marking (orientation of driving directions): no line or broken line / solid line
- Deleterious posts: absent / present
- Guardrail: present / absent
- Vertical grade: absent (0%) or present (slope)
- Roadway width: 7.5 m or less / 7.6 – 9.5 m / 9.6 – 11.5 m / 11.6 m or more

Exposure data:
- Traffic volume (AADT) from the National Traffic Census 2010
- Lengths obtained from GPS points

Safety: 5-year crash frequency from Police data (2005 – 2013), only single-vehicle crashes

RESULTS

Speed model:
- (6 variables)
- All variables (AADT, length, speed consistency) significant (although speed consistency only or 13% level), with positive relationship to crashes.
- Magnitude of regression coefficient is comparable to the results of other studies.
- Adding speed consistency to the model increases explanatory power only by 0.65%, This is comparable to 0.66% in Anderson et al. (3).

DISCUSSION AND CONCLUSIONS

Possible biases: omitted variables (pavement, super-elevation, etc.), speed based on one drive only, segment-level aggregation of speed, small crash sample.

The limitations are addressed in further stages of the project:
- sample enlargement in time and space, using vehicle fleet data from repeated drives (4)
- improvement of evaluation methodology (more data collection spots in curves).

In the future the concept may be applied in proactive network screening (identification of hazardous curves) instead of waiting for crashes.

Example 2 curves in buffer.

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REFERENCES

In the identified curves potential countermeasures (such as chervons) may be applied – consistently, for example based on speed or safety predictions from the presented models.